COMMONWEALTH OF AUSTRALIA

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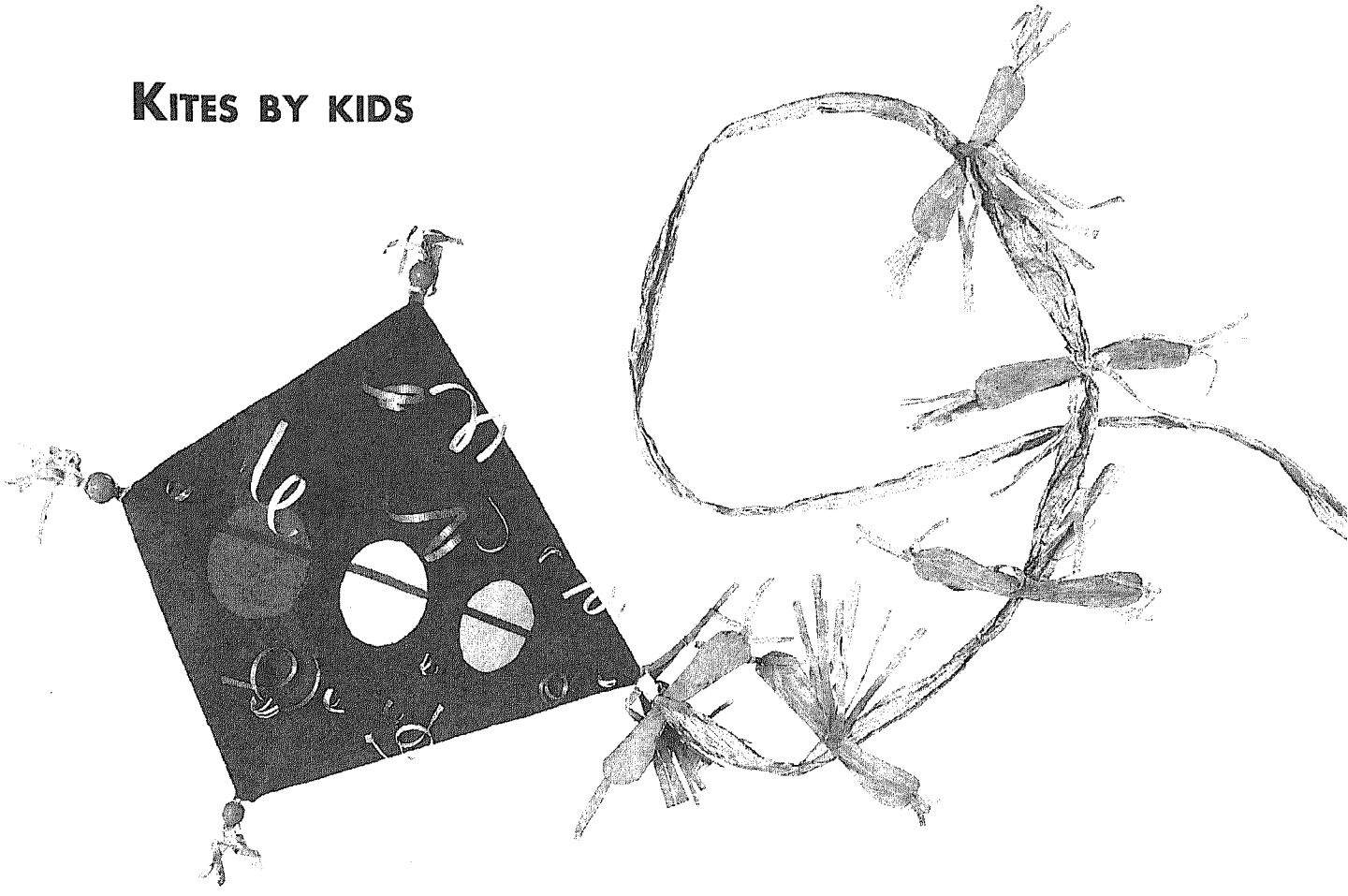
Warning

KITES BY KIDS



Making kites requires students to explore and use a range of materials in ways they may not have tried before. They need to think about the appropriateness of materials and the techniques required to meet very specific requirements. Kite flying is also great fun.

In this unit, encourage your students to set their own design criteria and to conduct tests to determine the best possible solution. You could also introduce the concept of "fair testing" in order to challenge students' assumptions about materials. In addition, students could explore specific production techniques, evaluate them and suggest alternatives.

After initial investigations, materials testing leads to design modification before final kite production. A similar process could be applied to other projects or briefs that require exploration of materials and the construction of particular items.

The design task

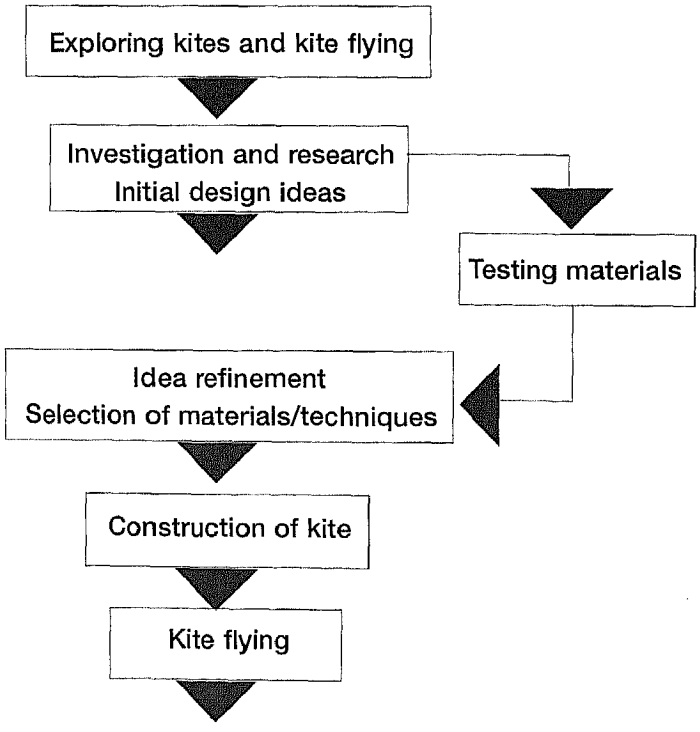
On a windy day, we can see the trees moving, papers flying about and the clouds being blown across the sky. When we try to walk into a strong breeze, we can feel its strength. In fact, the wind can be used as a form of power.

Kites use the wind to fly. They are used in weather forecasting, for sending messages and transporting people.

Kite flying is also fun!

Design and make a kite that will fly in the wind.

Unit outline



Focus on strands/strand organisers

This unit was planned to allow students to work towards different levels of outcomes within common settings. The scope of these activities reflects the intention of the teacher to meet the needs of all the students in the class.

The following activities undertaken during the unit demonstrate development of learning in each of the substrands at different levels. They may lead to achievement in profile levels, as indicated.

Designing, making and appraising

Investigating

- flying the kites; valuing students' prior experiences of flying and kite flying (levels 1-3)
- gathering information from a variety of sources, especially pictorial and audio-visual texts
- gathering information on the history of kites and the use of kites in other cultures (levels 1-2)
- analysing sample kites, and observing, identifying and comparing features of different kites (levels 3-4)
- developing experimental procedures, setting of desirable criteria and conducting fair tests to determine characteristics and suitability to meet criteria (levels 3-4)
- organising information for later reference

Devising

- identifying features (requirements) to be included in designs (levels 2-3)
- generating initial ideas from personal experiences, reference materials, Festival of the Winds, slides, and so on (level 1-3)
- modifying ideas, following testing of materials and experimentation with sail shapes and sizes (levels 2-3)
- emphasising development of designs that are aesthetically pleasing as well as functional (levels 2-3)
- representing ideas, using annotated drawings to specify materials, dimensions and features (levels 1-3)
- modification of product, following test flights (levels 3-4)

Producing

- manipulating and experimenting with materials to make models for use in investigative tasks (levels 1-2)
- identifying safe use and maintenance of equipment (levels 2-4)

- combining a variety of materials and components – covers, frames, flying lines – to make a kite that meets requirements (levels 1-3)
- selecting and learning techniques for shaping and joining fabrics, plastics, wood and wire, as appropriate to individual design requirements (levels 2-3)

Evaluating

- making judgements about appropriate materials, and shaping and joining techniques, to maximise performance of the kites and meet the design requirements (levels 2-3)
- test flying, to try out the finished kites and make modifications as required (levels 2-4)

Materials

Nature

- identifying features of materials (levels 1-2)
- matching features to purposes of components in the construction of the kite (levels 3-4)
- exploring and testing materials, and identifying and comparing characteristics and performance (levels 2-4)
- making selections based on findings, and matching features and performance to requirements (levels 3-4)

Techniques

- targeting techniques introduced and skills developed, for example, hot-glue gun (levels 1-2)
- focusing on the safe use of equipment (levels 1-3)
- developing skills, as required, to work with selected materials (levels 2-4)

Organisation and Planning

Class information

The unit was implemented in a Year 4 mixed ability class in which few students had much experience of technology activities. Generally, they lacked the confidence to make decisions without the approval of the teacher and often sought reassurance.

> *Several students exhibited a tendency to retain their very fixed ideas. Others made assumptions about how things worked, without feeling much need to be able to explain or justify their ideas.*
>
> *I used information-gathering techniques to challenge the students' ideas and expected them to back up their suggestions with evidence.*

Time allocation

The unit was undertaken during a single ten-week term. Integration was possible only in some learning areas because of the school timetable. Given more flexible time arrangements and further opportunities to link activities to other learning areas, the duration of the unit could be reduced.

Timing of unit

Although the unit was implemented in spring, when the annual local Festival of the Winds is held, the class nevertheless experienced the frustration of windless days. Another time of year may be windier, but unreliable winds will probably be a feature at any time. Students could undertake a parallel investigation of wind and monitoring and measuring wind patterns to discover whether one part of the year is better than another for flying kites.

Links to other learning areas

Activities in this unit can be integrated with other learning areas, as suggested below. Further activities could be incorporated, according to the needs or interests of the students.

Mathematics

- Estimate, then accurately measure commercial kite components.
- Suggest dimensions of initial kite ideas by "measuring it out", using metre rulers and tape measures.
- Construct a kite to the group's specifications.

Science

- Make a simple helicopter by cutting to the midpoint of a sheet of paper, bending each leg in opposite directions and weighting the top with a paper clip.
- Blow across the top of two plastic cups, one of which is inside the other.
- Blow across the top of a cup which is holding a ping-pong ball.

Kites by kids

English

- Read *Things aren't what they used to be*, by David Corke.
- Explore "Why are people intrigued by flight?"
- Research kites.
- Investigate the history of the kite (and its place in other countries), aerial art and sport.

Health and physical education

- Research the hazards of flying kites near power lines.

Introducing the design situation

Begin with some preliminary questions to ascertain students' knowledge, perhaps by discussing their experience with types of toys that fly. Mostly, this will mean kites or motor-powered planes. Suggest that the children bring some of these to school with them to allow observation and discussion of the mechanisms that allow them to fly.

During a library lesson, the students could collect stories about flying and share them throughout the week. They might talk about:

- what flying might feel like;
- why people want to fly;
- their experiences of flying in planes.

Three students volunteered that they had kites at home. They brought them in and the class headed to the playing field one almost-still afternoon. Everyone took turns handling the kites, which involved lots of running, untangling and crashing.

Later, we hung the kites in the classroom so that the students could look at and refer to them.

Where will we find information?
the library
hobby shop
parents
friends
videos
teachers
our wall charts
stories
by tryng things
the kite shop in Darling Habour
the yellow pages
pilots
airlines
the airport
scientists

Figure 1.

Figure 2.
Teacher: "It was quite surprising what the students talked about – angle of the kite, size, shape, wind direction, function of a tail, untangling flying lines. They got very excited when I suggested they could all make a kite."

Investigating by flying kites

This afternoon our class went to the playing field to fly kites. My kite was made of paper and had a great fierce Japanese face on it. My Dad brought it for me. I thought it looked better than the other kites, and so did James and Sam. But my kite didn't fly as well as Sue's. I need a longer string. Sue's was like a box and it went much higher than mine. I'm not sure why, but I think I will experiment with that shape to see if it works better.

Going to the playing fields was great fun. I can't wait to make my own kite. At first I couldn't fly the kite even though I ran my fastest. It was better when I jumped off the seat and got some air underneath, but the long tail got ripped when I tripped on it. I don't think I'll put a tail on my kite, but it did look good when Michelle flew it. It waved in the air and looked like a long red flying worm. I wonder if a kite needs a tail.

Introducing the design brief

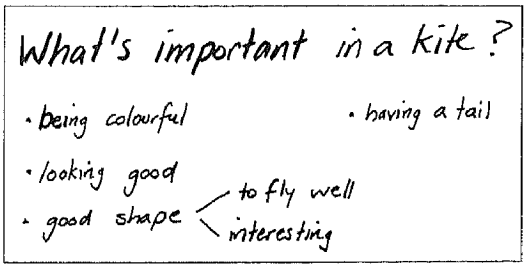
Introduce the idea of making kites to the class. Your questions might include:

- What sorts of kites are there?
- How do you make a kite?
- What can we use to make one?
- What do you think are the important features of a kite?

Students' initial responses might be slow at first. Soon, however, ideas will flow, based on their immediate, if limited, experiences: kites have a tail, are colourful, look good, have a good shape (for some this might mean "effective", for others, "interesting") and fly well. Record their ideas for later reference.

It is important that everyone realises they need to do some investigation before they can actually start.

Figure 3.



Finding out about kites

The class could watch a video, such as *Birds Can Fly, Why Can't I?*, and record information as dot points. Then they could discuss the points raised, such as lift, thrust, drag, weight, curved wings, the anatomy of birds, and the structure of wings.

Next, get the students to compile their notes and discussion points on to a second chart, under the heading, "This is what we've discovered about flying", and add to it as the unit progresses.

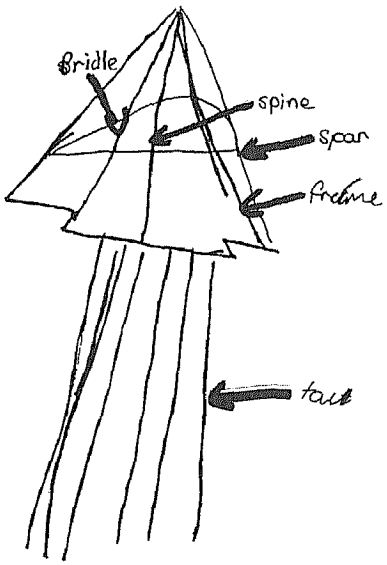
The students' questions could well prompt you to structure further science investigations to explore some of their ideas. (Refer to "Links to other learning areas", page 55.)

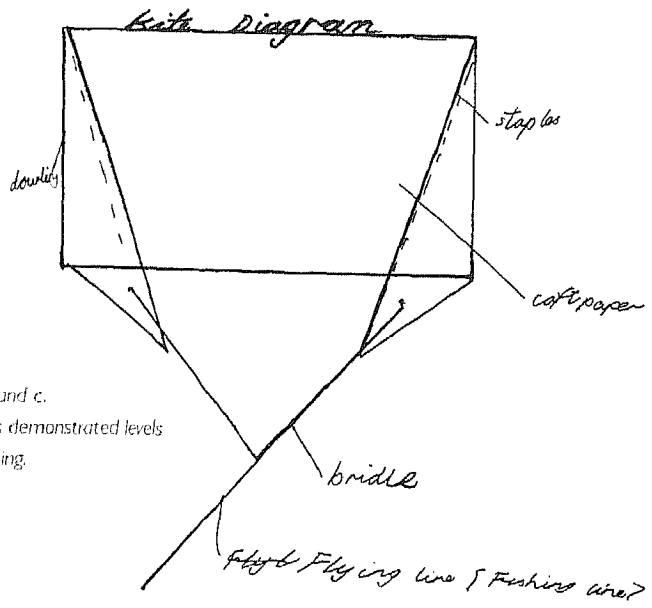
Remember to ensure that the students are using a wide range of sources for information, especially audio-visual resources and people, rather than just print material.

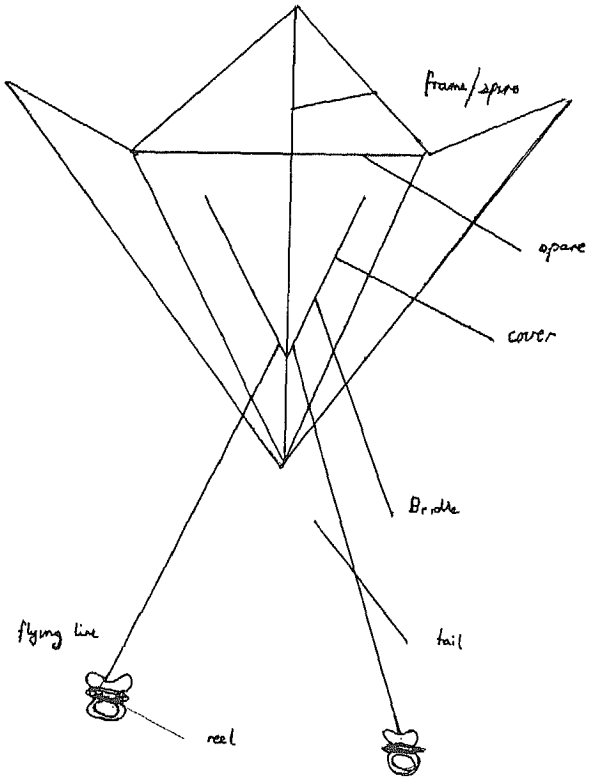
A range of activities can help build up a bank of ideas.

- Viewing slides and discussing accompanying information. Slides can provide a wide range of ideas about kites and flying devices.
- Individual class members may have previously completed a relevant research project. Encourage them to share this information with the rest of the class.
- Students could collect pictures and posters of aircraft types, such as hot-air balloons, gliders, aeroplanes, and helicopters. Students could then categorise items, identifying features, describing good points, suggesting limitations, and bring the information together in a display.
- A video about flight could focus students' attention on how different aircraft worked.

After displaying the kites they have flown, the students could examine them and suggest names for the various parts. After the information-gathering exercise, most students will identify most of the components, using conventional terminology. Get them to draw a simple kite and label the parts that they think are important.







Figures 4a, b and c.
Most students demonstrated levels 1-2, Investigating.

Comparing kites

	box kite	japanese face	plastic
size	1metre		
tail	no	yes	yes
shape	cubes and a rectangle	triangle	diamond
flying line made of	thick line	fishing line	fishing line
cover made of	material	plastic	plastic
struts	dowl	plastic	light steel

Comparing kites

	BOX kite	Japanese face	plastic
size	bigest	middle	small
tail		yes	yes
shape			
flying line made of	don't know	plastic	fishing line
cover made of	like a shirt	plastic	
Colours	Blue and red	lots	Yellow and red

Figures 5a and b.
These judgements about the effectiveness of the kite and appropriateness of materials used suggest movement toward level 3, Evaluating.

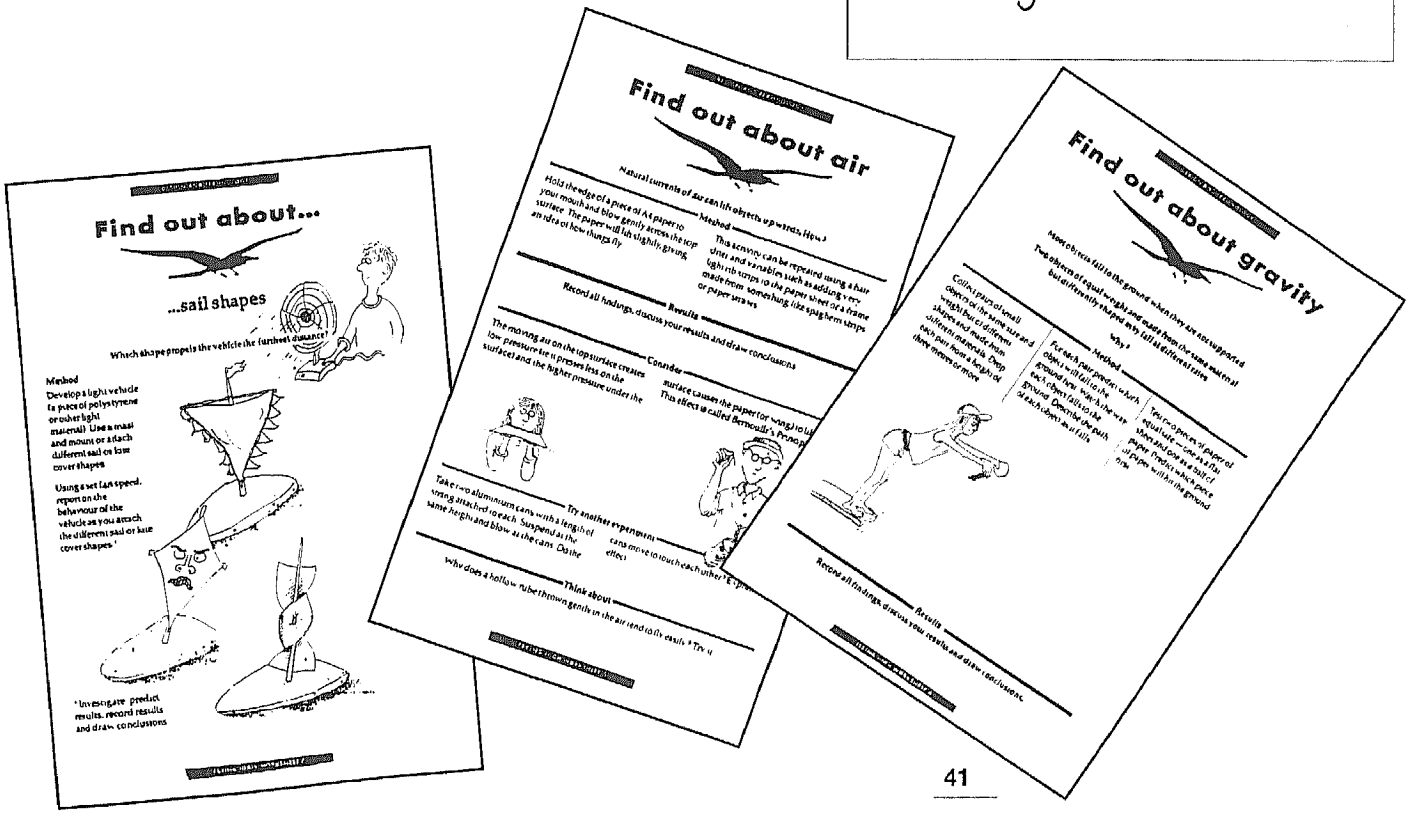
Periodically, refer the students back to the question, "What do you think are the important features of a kite?" Encourage them to add further ideas that they might find interesting or useful later on.

Ask students to select three sample kites from the display and make direct comparisons of the components in each.

Investigating how kites fly

Using worksheets 4, 5 and 8 from "Fying high", in *Design and technology, years 7-10 teaching kit*, 1992 Board of Studies NSW, Sydney, students, in co-operative groups, could conduct experiments to identify some principles involved in flight.

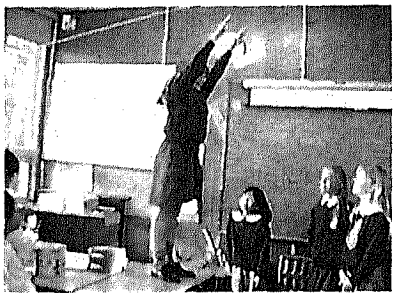
Figure 6.



Finding out about gravity

Using a worksheet on gravity, I modelled the experimental procedure students were developing, and the class completed the task by:

- *predicting what would happen;*
- *describing what they observed;*
- *discussing their findings.*



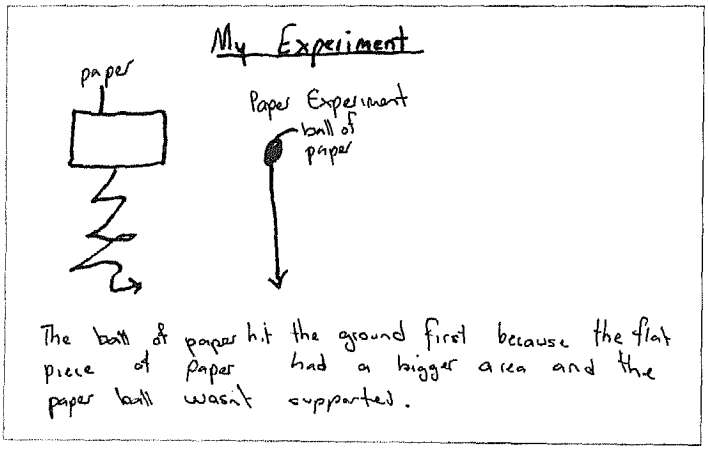
Initially, I stood on the desk with two pieces of paper (one scrunched into a ball and one flat) and asked the class to predict what would happen when I dropped them. All expected the balled paper to land first.

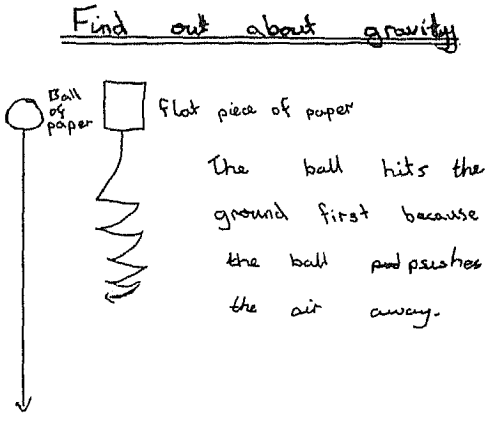
When asked why, George suggested that the ball was heavier. He couldn't say what made it heavier but said it was because I had scrunched it up. We weighed them both and found that this was not the case. Megan came up with the idea that the ball was denser.

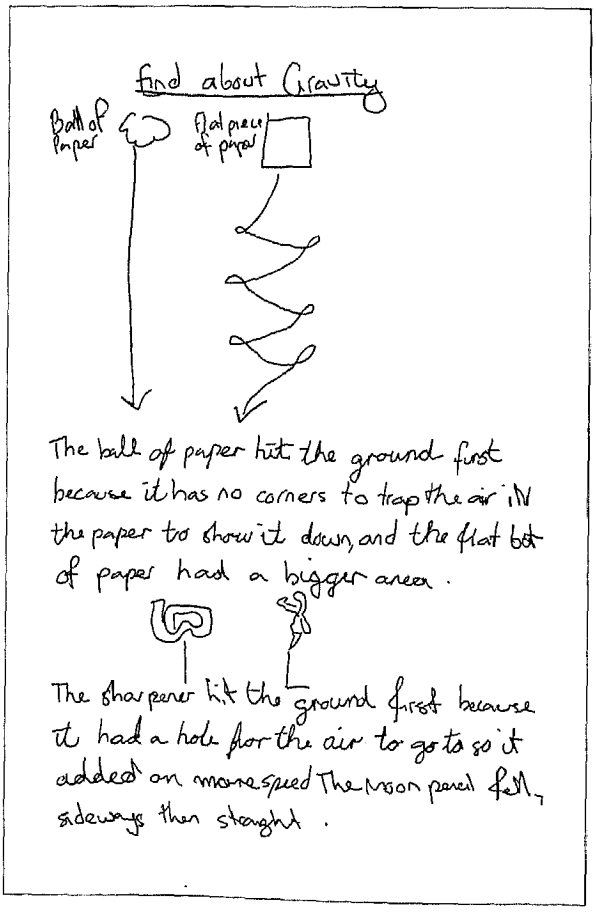
After watching me drop the two papers, almost everyone thought that the open sheet was supported by the air. They were happy to stand on the desks and drop sheets of paper close to the noses of observers lying on the floor.

Groups also tested other objects, and used scales to measure the mass of each object dropped.

Figures 7a, b and c.







Testing sail shapes

Next, we borrowed water trays from the kindergarten and held sailboat races in the middle of the class garden. Each group made three boats with different shaped sails attached to polystyrene boat bases. Finding out how to cut the polystyrene proved interesting. Some of the students tried scissors and others saws. I showed the students how to score the material, using opened scissors, and then bend and snap the polystyrene. It proved a good time to focus on safety when using equipment.

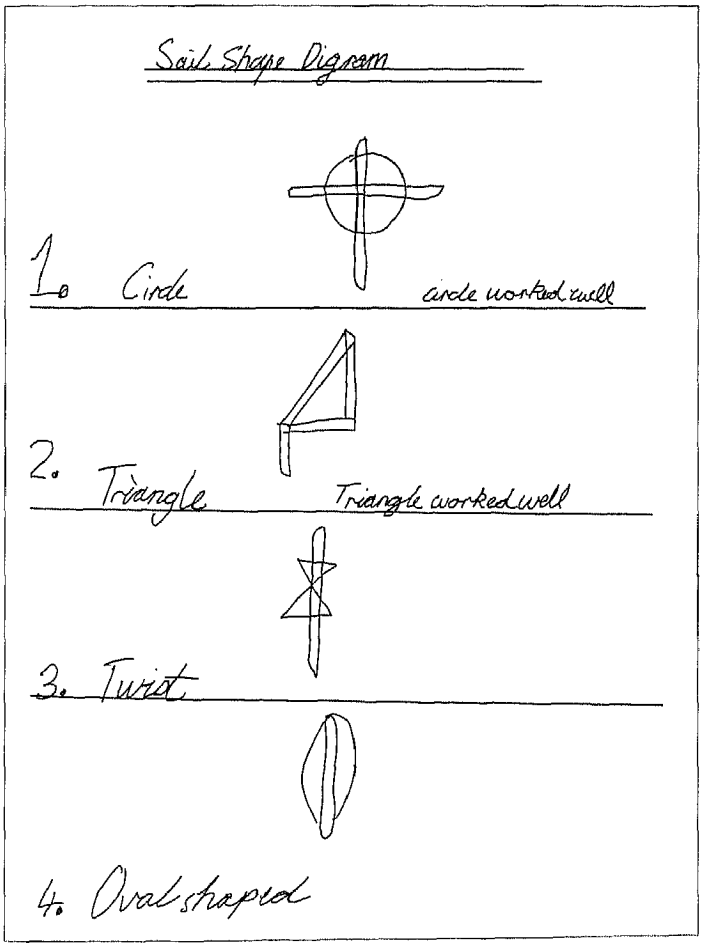
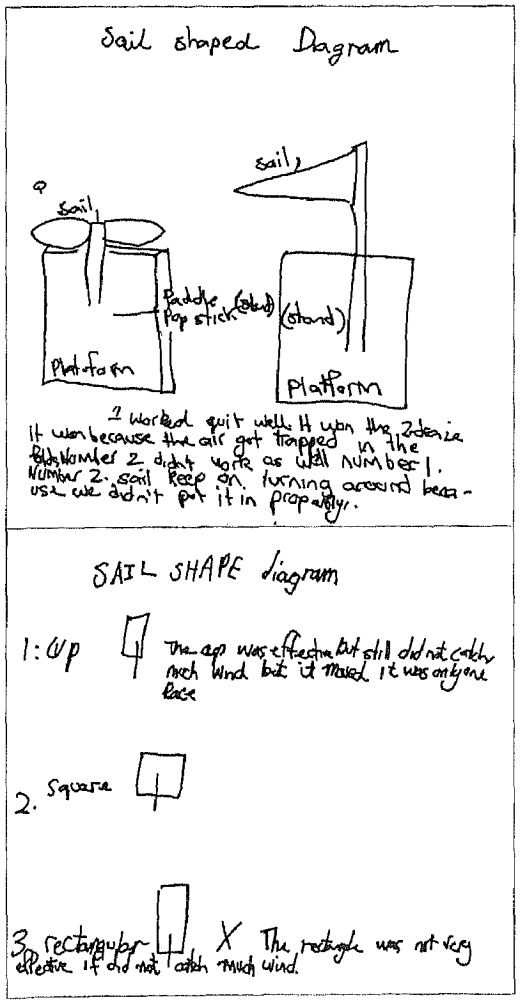


Figure 8.
Simple observation, indicating level 1, Investigating.

Figures 9a and b.
The students are beginning to identify reasons for events and the effects of different test items; these two samples suggest level 2, Investigating.



Learning safe work practices

When introducing a hot-glue gun, show each group how to load and use it. Talk about safety and, based on the safety points generated by the class, have a pair of students make a chart with the title, "Hot glue! – safety hints". Display it in the area where the glue gun is used.

2.

I suggested the students make different sail shapes and hot-glue them to crossed popsticks. Some students split the sticks to keep the frame as light as possible. Most favoured plastics for the sail material, although some used cellophane or cotton fabric.

Recording ideas for later reference

Encourage the students to observe the characteristics of the different sail shapes, materials, and so on, and to record how they perform and what worked well. Let them make alterations while they are investigating, and get them to record the effects of these changes, too.

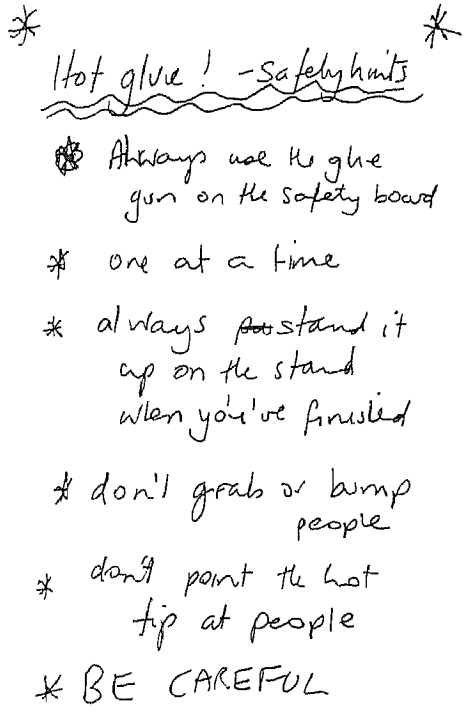


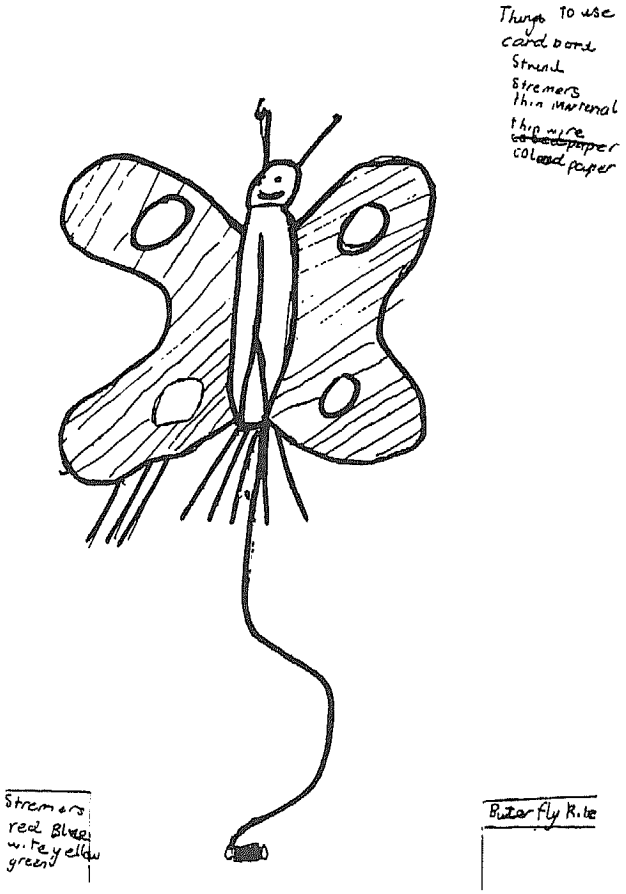
Figure 10.
This chart was initiated by a pair of students as an extension activity. They demonstrated concern for safe work practice, indicating level 4, Producing. Not many students in the class were at this level.

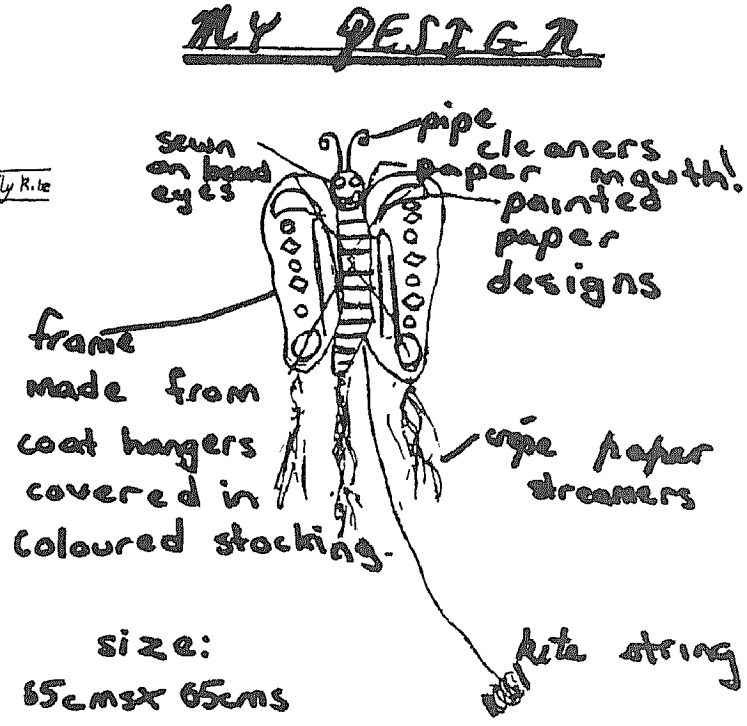
At this point, it might be appropriate to revise the investigative work undertaken so far. Ask the students to reconsider the question, "What are the important features of a kite?"

Through group, and then class discussion, get the students to agree to a set of criteria or suggested features for the kites. They might agree, for example, that successful kites are likely to:

- be as light as possible;
- have the greatest possible area of cover;
- have a strong line;
- use strong material that won't tear;
- have a colourful or interesting decoration.

Most students wanted to work on their initial designs in pairs. Several referred to books and wanted to copy a design directly. I explained that it was fine to look but that they should use the ideas to come up with their own design.





Figures 1 1a and b.
Two representations from the same group, demonstrating differences in skill. Nina has drawn a simple picture with minimal detail, indicating level 1, Devising, while Louise has considered materials to use and methods of attaching components, and has detailed her ideas, indicating level 2, Devising.

Investigating appearance

By now, students will have access to a variety of sources of ideas: slides and pictures, videos, and the kites they have flown. Get them to review all the information they have.

The local Festival of the Winds was on, and some students went and observed the kites. Others made a point of watching the news for information about the Festival.

Figure 12.
This very simple representation of a kite shows little detail about materials, indicative of level 1, Devising.

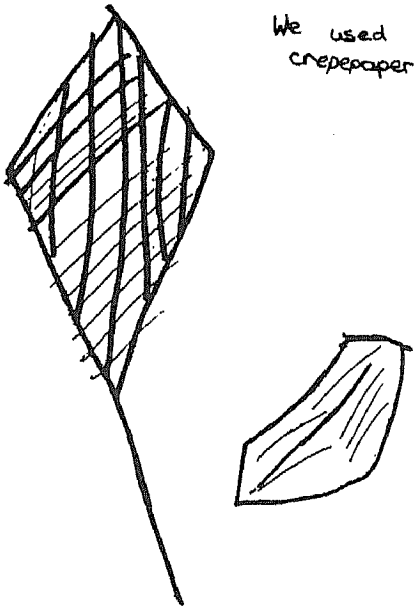


Figure 13.
This student is experimenting with drawing techniques to represent 3-D shapes, detailing dimensions and proposing materials; moving towards level 3, Devising.

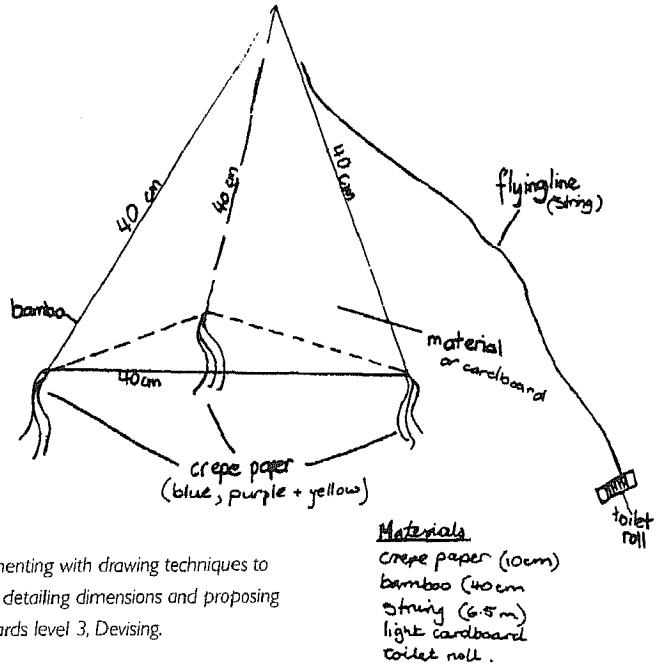
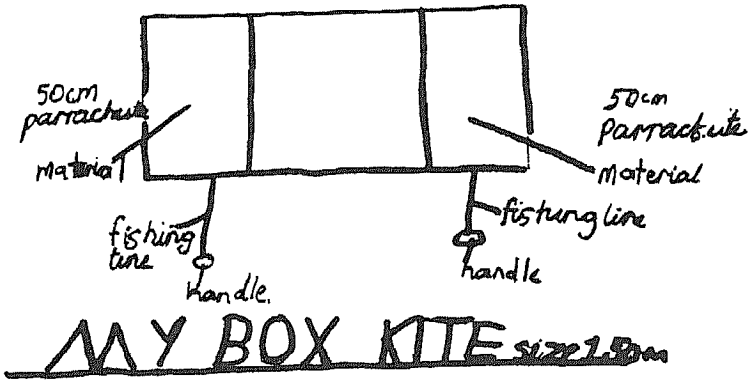


Figure 14.
This simple representation, thoughtfully annotated, is indicative of level 2, Devising.



Developing ideas

Students could draw pictures of their initial ideas. Working in pairs, they adapt, modify and finally make good copies to display to the rest of the class. Encourage them to include as much detail as possible. Many will have great ideas for elaborate kites in all sorts of shapes.

Some pairs might produce initial drawings that specify dimensions and materials, and represent functional components. Others, however, may not indicate the materials to be used or indicate measurements.

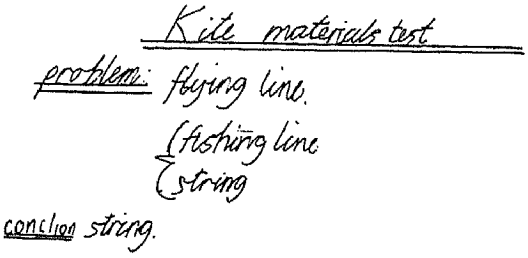
The selection of appropriate materials can become a dilemma for those who don't know where to begin. You could refer them back to the kites they have flown and the slides they've seen for further ideas.

What materials make a good kite?

Once their initial design ideas for the kites have been recorded, the students could begin to focus on investigating materials that might be useful. They list specific properties that would be desirable in a cover material, and bring in any materials they feel would be appropriate.

Appropriate materials might include plastics, nylons, polyesters, cotton poplin and lawn. Students will mostly have access to more common materials, such as cotton, synthetic fabrics, plastic, crepe paper and cellophane.

Figure 15.
A simple list of materials, lacking reasons for choices made, indicative of level 1, Materials.



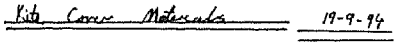
Testing cover fabrics

Encourage the students to devise their own tests to determine which materials might be most suitable for their kite covers in terms of the criteria set, including:

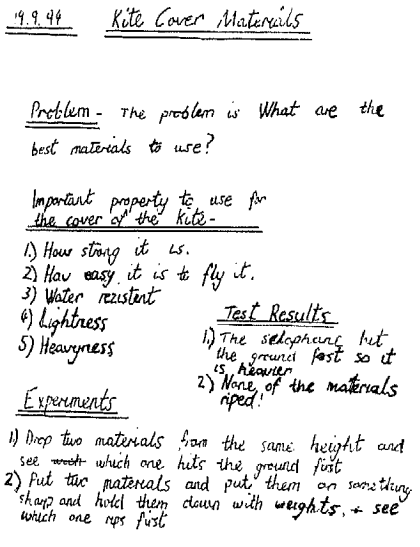
- mass of fabric;
- tear strength;
- durability;
- the ability to join materials.

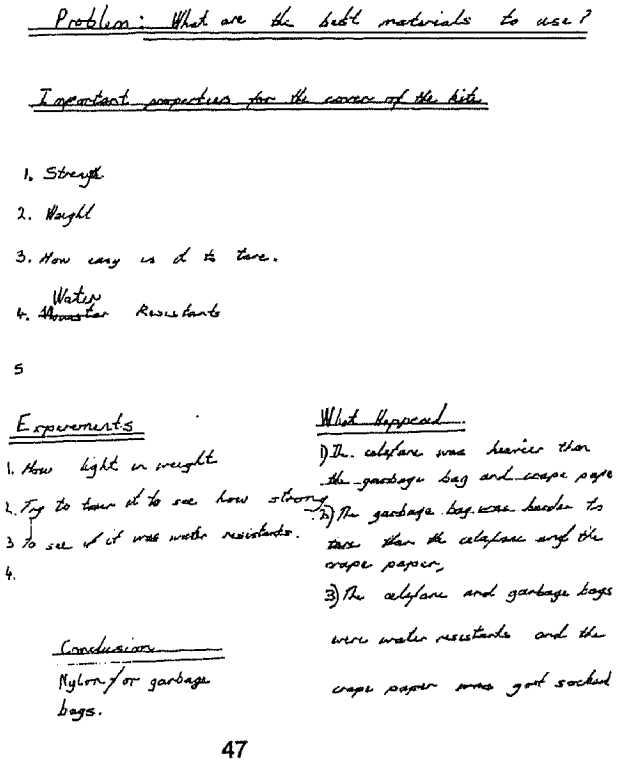
To test the strength of the materials, my students proposed pulling the fabrics to find out how strong they were. But they couldn't decide how to make the "pulls" equal. They suggested that kilogram masses could be used and decided that they could suspend the material or pile masses on top.

Figures 16a and b.
These students relate their findings to their design needs; moving towards level 3, Materials.



The students record the results of their tests, including tests for wind permeability, suitability as parachutes, ability to support weight, resistance to tearing, and the effect of moisture on their construction.





Testing frame materials

We conducted investigations in groups. Some students felt they were "sure" of the materials they needed, and some of their suggestions proved worthwhile; others were revised after testing. We spent one and a half afternoon sessions testing materials, so that students could begin construction as soon as possible.

Have the class discuss and identify the desirable features of a kite frame, for example, durability, flexibility, moisture resistance, ease of attaching the cover, weight, cost and availability of materials.

Each group could conceive and carry out tests on materials, including:

- metals, for example, aluminium foil, wire, tubing;
- timbers, for example, dowelling, balsa, bamboo, cane from blinds;
- plastic strips from window blinds, edge strips, fishing line, cotton thread.

Since many commercial kites use a dowelling frame, this material may prove a popular choice. Plastics, wire and bamboo are other materials that could be considered.

3.

4.

Frame Flying Test 20/9/94

Materials : wood, wire

Test : We found that the wire was stronger.

Results : We decided to use wire

Conclusion : We are going to use wire because its light and is easy to shape.

Figure 17.
This student is beginning to relate findings to requirements of a kite, indicating level 3, Materials (nature).

Testing flying-line materials

After discussing the properties needed for the flying-line, students might identify these characteristics:

- strength;
- lightness;
- easy to wind onto something;
- not too rough on hands.

Testing the lines was a difficult task for many of the class. One group thought that by dropping string and fishing line they could find out which was stronger. Only Dinesh and Neil tested equal lengths of different lines for weight. They were very particular in measuring.

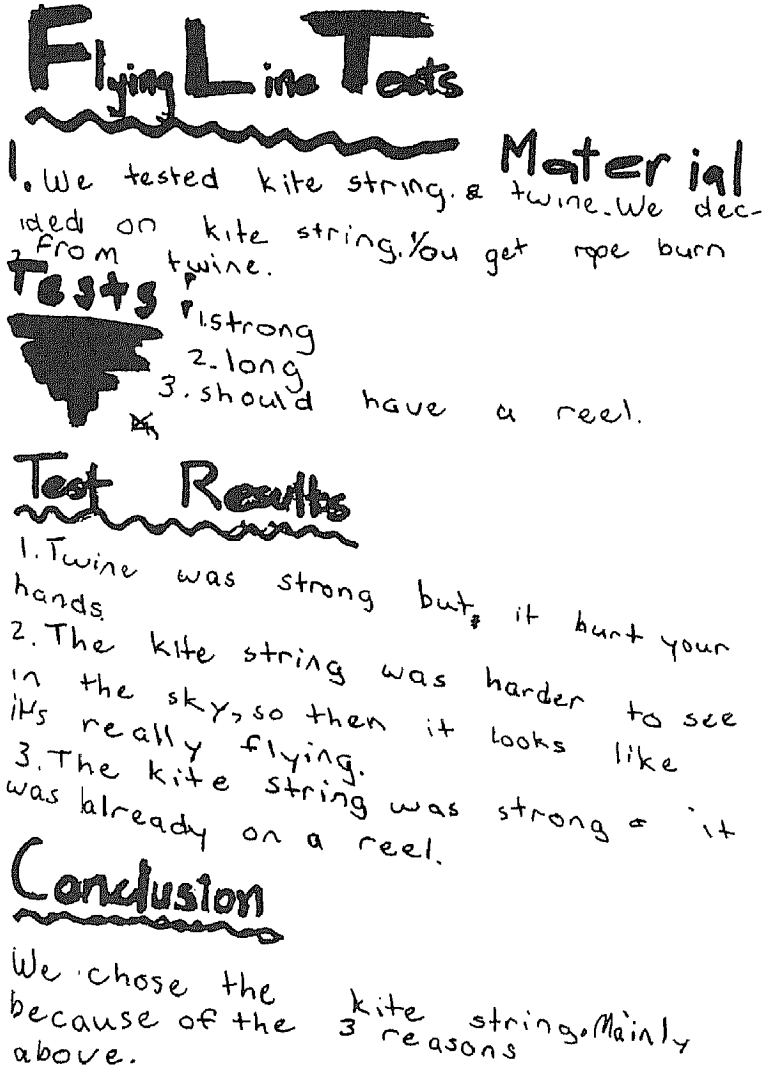


Figure 18.
Both functional and aesthetic considerations are identified as important in materials selection, indicating level 4, Materials.

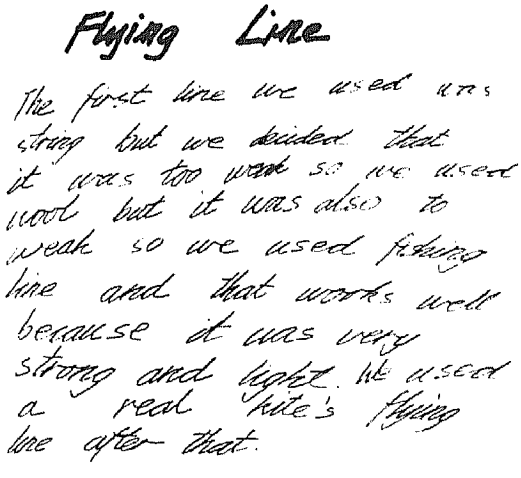


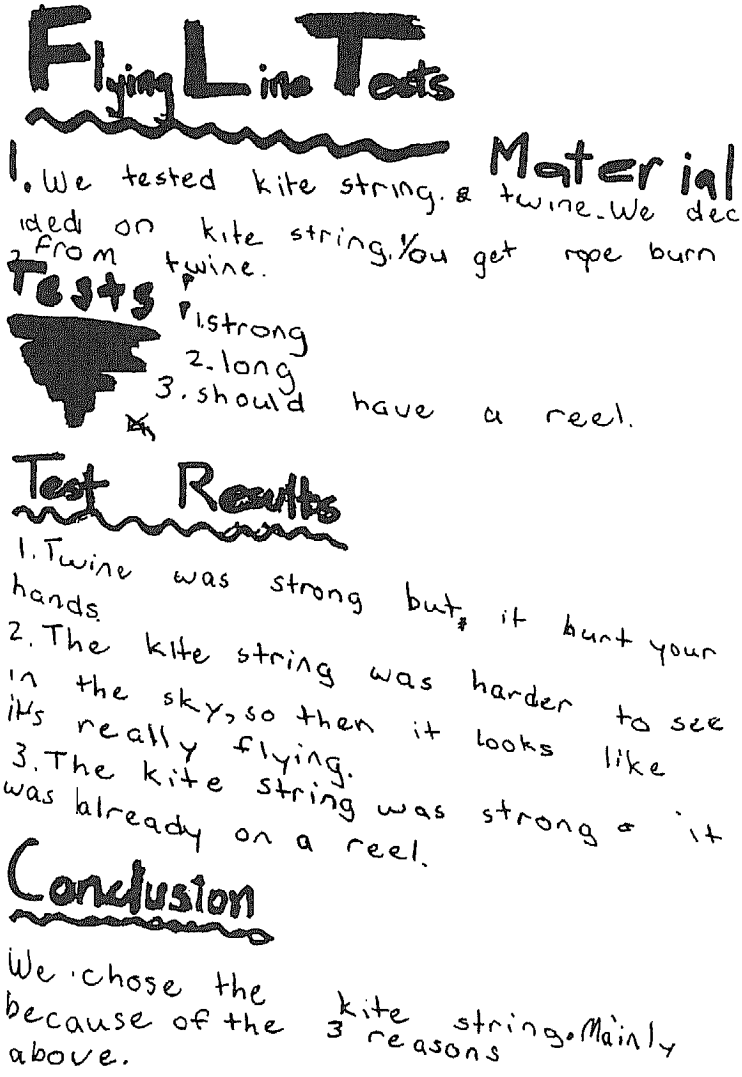
Figure 19.
This group used trial and error, rather than making judgements about appropriateness, indicating level 2, Materials, and level 1, Devising.

Testing flying-line materials

After discussing the properties needed for the flying-line, students might identify these characteristics:

- strength;
- lightness;
- easy to wind onto something;
- not too rough on hands.

Testing the lines was a difficult task for many of the class. One group thought that by dropping string and fishing line they could find out which was stronger. Only Dinesh and Neil tested equal lengths of different lines for weight. They were very particular in measuring.



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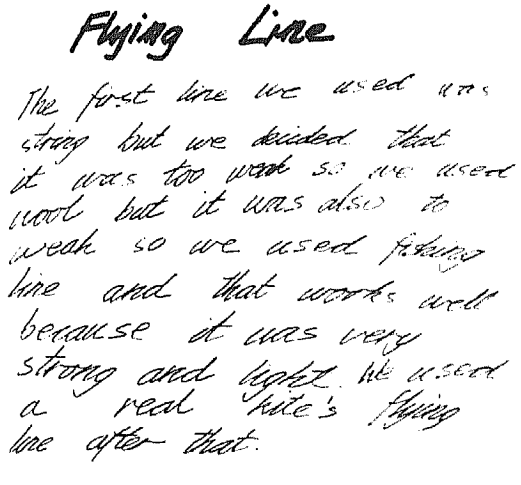


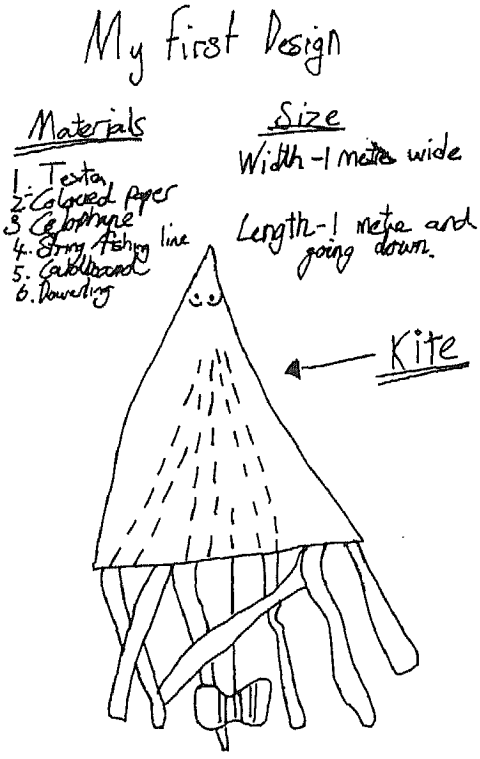
Figure 19.
This group used trial and error, rather than making judgements about appropriateness, indicating level 2, Materials, and level 1, Devising.

Developing and refining ideas

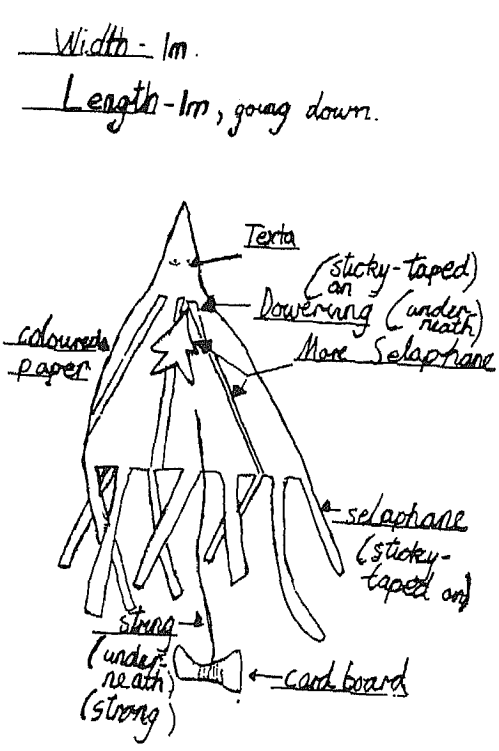
Before testing, it is likely that students will have firm ideas about what will be the best material. After they have tested different materials, encourage them to use their results. This can be quite difficult for some students. Many of them may need to do further work on evaluating which materials best meet the criteria.

At the end of the testing period, each group could make recommendations about the material they would choose for their cover, frame and line. These can be shared and justified when each pair's final design is presented.

If this is the students' first experience of fair testing, they may need further practice to develop the confidence to "believe" the results, rather than just accept preconceived ideas.



20a



20b

Figure 20a and b.
Progression in thinking has occurred through experimentation and testing, suggesting movement from level 2 to level 3, Devising; indicative of level 3, Materials.

In hindsight, I might have been better to allow a few of the students to construct their kites and make modifications after testing.

Following their investigation of materials, students prepare a new drawing of their kite. This should be their final design, and take into consideration all the tests carried out on various materials. At this stage, they label the kites in detail.

Some groups may be concerned that they have changed their ideas since their first design. Discussion will help them appreciate that this is exactly the way designing occurs. Others will realise that they can't easily make their initial design, and modify it to make it more achievable.

In pairs, each student could briefly detail their design, describing the basic materials and construction techniques selected. Having worked out how to make their kites, they will be eager to get on with it.

5.

Building the kite

Establishing safety regulations and procedures for using equipment is critical. Generally, this means a reinforcement of the procedures already established during the materials-testing stage.

Students will probably work out their own methods of joining materials together – for example, gluing, stapling, stitching, or binding. As necessary, discuss possible methods and examine available models to identify how they were constructed. Some groups may think no further than the hot-glue gun , though, of course, there are a variety of other methods readily available.

6.

Equipment and methods used will depend on group requirements. Individual groups may need to be shown how to:

- use pliers (for cutting wire);
- use and refill the glue gun;
- sew, using needle and thread;
- use the sewing machine for simple fold-over seams;
- use a saw to cut dowel.

Next, the students can begin to construct their kites, using their selected technique. They should start by reviewing their lists of materials. Some groups may be able to list the order in which they would undertake each stage of the task (level 3). Others may only be able to do it as they go along (level 1). Often, groups will start with the frame and then cover it (level 2).

Figures 21a and b.

Kite results

Our kite was unable to fly because of unstable stitching. Plus it was too windy

Changes

Where going to use Jimmy's sewing machine and a key ring to attatch the fishing lines.

Design

We're going to keep our design.

HOW TO FIX MY KITE

First we tested some materials like String, Wood and Cardboard to See if they were suitable. We tried to fly our kite but it didn't really go off the ground very far

We Could make it bigger and make it with much lighter Cardboard or paper. We could put a much longer tail on it After the holidays we are going to try to make our kite fly better

Only one group in the trial class divided the tasks and worked on both frame and cover concurrently (level 3). For most groups, making the kites will take about three afternoon sessions.

Decisions about the addition of a tail and how long it should be will result largely from trial and error during test flying. Students may have observed that some commercially available kites do not have tails, but their tests will probably indicate that a tail adds stability. Get the class to explore drag by running with an open umbrella and then discuss the types of aerodynamic shapes that occur both in nature and in manufactured items.

7.

8.

Making modifications

Your students will probably suggest places appropriate for flying kites. Get them to think about overhead wires and trees. Some of them will have tried flying kites on windless days and others may have felt the burns of flying lines when flying commercial kites on windy days.

The students were keen to run with their kites, but often their first attempts to fly them were very disappointing and many modifications and running repairs were necessary. Time was then spent making modifications and they had greater success the second time round.

Evaluating their designs

The students are familiar and comfortable with self-evaluation and have used the method in projects, talks and co-operative activities in other learning areas. However, their comments have frequently been rather superficial.

MODIFICATION

The changes Kad and I did was put a longer tail and more tape we learnt to do this didnt the chances because we saw lots of kites and some suff we dint

Modifications

I didn't think that taping the bridle would work. Next time we'll sew it on. Its easier to fly without the tail, But the kite flyies well other wise I reckon our kite is an original Its not diamond, or aurplane like, . . . Its different it flies well & I enjoy flying it.

Figures 22.
Evaluation, primarily in terms of own likes, indicates moving toward level 2, Evaluating.

Suggest that the students compare their final kite to the criteria they established at the beginning of the unit. Discuss the list of features they thought it was important to have in a kite, and get them to compare their kites, identifying changes made to the original ideas.

Talk about the skills and ideas they have learnt, the new tools they have used, how well organised they've been, and who in the group stood out and for what reasons.

9.

KITE

I think I managed my kite pretty well. I learnt how to use the hot glue Gun and other tools. I learnt not to use paper or wood because they rip. Or not to use String My kite flew well on the day. It went up very high when ~~ther~~ there was a strong wind but when there was just a little wind my kite crashed. I learnt that kites need to be light to be able to fly. Toilet rolls are no good for the line because the string keeps slipping off and your kite falls down. Also Flashing line gets tangled and you have to cut it off. Cardboard always rips so it is a good idea that you ~~use~~ don't use cardboard.

Figure 23.
These judgements about the effectiveness of the kite and the appropriateness of materials used suggests movement towards level 3, Evaluating.

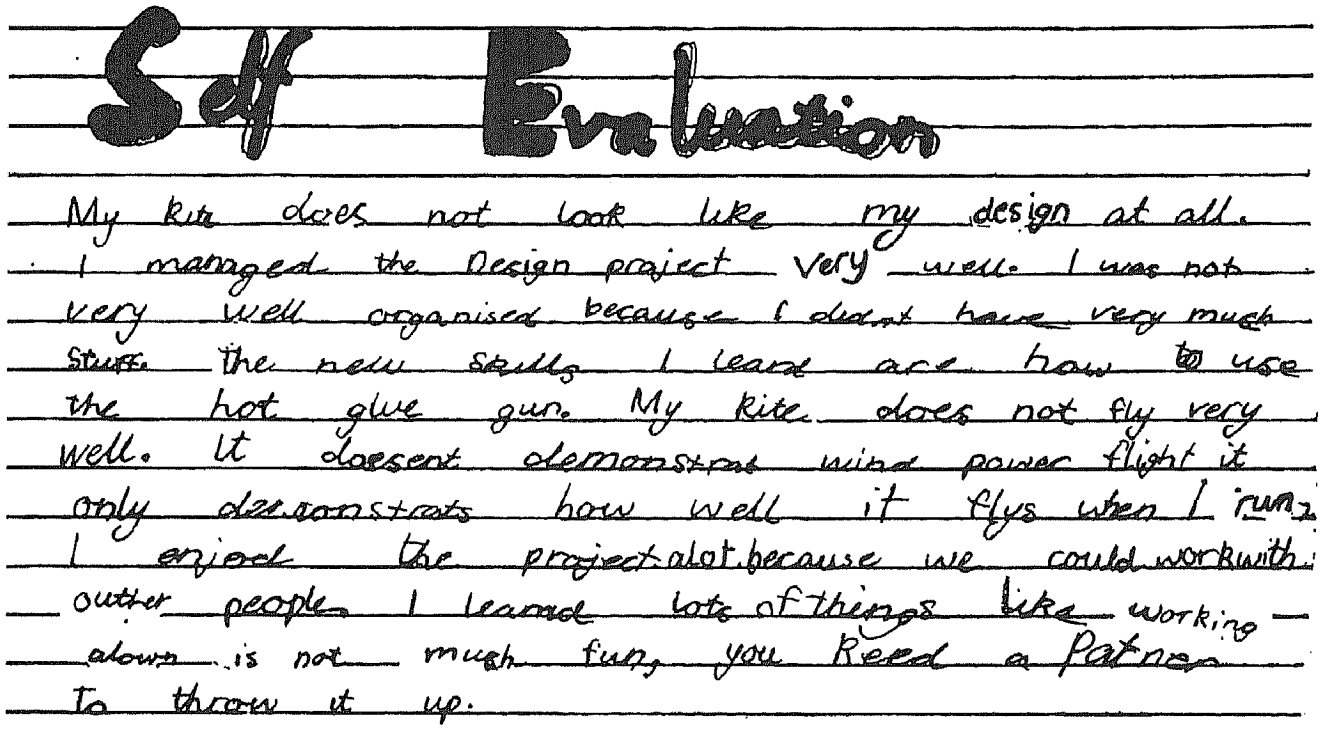


Figure 24.
Moving from level 1 to level 2, Evaluating.

Some students had difficulty coming up with informative and useful comments beyond their own opinion of the kites. Others were able to make some comparisons with the set criteria and to suggest ways (even if not always practical) of improving their kites, suggesting movement towards level 3, Evaluating.

One student commented that it didn't matter if his kite wasn't a great flier, it looked really cool – and that's cool.

Where to from here?

Further activities could be undertaken, if interest and time allows. Some suggestions include:

- working out the costs of mass production of kites;
- devising a marketing plan for the kites;
- publishing instructions for flying kites;
- inviting an expert to take part in the evaluating process.

LINKS TO OTHER LEARNING AREAS

As a learning area in its own right, technology ensures the comprehensive treatment of specific skills and understandings through a combination of theory and practice. At the same time, the development of particular skills and understandings in this area of the primary curriculum transcends the boundaries of a single discipline and highlights the importance of technology in the curriculum of primary schools.

Challenging a narrow interpretation of technology education requires careful selection and placement of activities. The units of work in this book demonstrate a variety of contexts, approaches and applications.

In technology, students utilise their learning from other areas of the curriculum. They are required to use:

- mathematical skills and understanding;
- communication skills and understanding;
- understandings of people, societies, environments, and so on;
- practical and creative skills;
- scientific knowledge and processes: testing and developing explanations.

The integrated nature of the primary curriculum emphasises the role of each of the learning areas. Integrated units of work in this document do not undervalue the skills and understandings which are specific to the technology learning area. Instead, they are presented as a means for enhancing outcomes across learning areas. This is evident in the selection of learning experiences and identifiable in the work samples of the students.

The richness of the integrated environment leads to a wealth of ideas. Teachers may be tempted to use many different activities in order to demonstrate links to other learning areas. The reason for their inclusion should be carefully considered. Whenever we integrate activities, we should address the outcomes of each learning area involved.

Technology tasks may arise from a unit with an initial focus in another learning area. For example, a health-based unit may lead students to research skin cancer and result in them designing a method of sun protection. A language-based unit may lead to the creation of a puppet show. Antartica was the focus for a "Studies of society and environment" unit, and led to the development of the "Waterworks" unit.

When technology is the focus of the unit, other issues arise from activities. "Kites by kids" leads to a range of science activities, as students investigate flight and test materials. The development of information products promoting water conservation, in "Water works", might lead to a range of activities in English. Model building, in "Changing environments" means that students need to incorporate their mathematics skills and understanding into the process. In each instance, outcomes in appropriate learning areas need to be considered in the planning of the activities.

When making decisions, students are required to reconcile a range of considerations, such as quality, function and cost, as well as more subjective matters, such as ethics and appearance. Such skills apply to all types of learning.

The selected work samples present the collective application of the experience, knowledge and resources students have at their disposal through quality teaching and learning experiences. Students who are able to transfer their skills and understanding and apply them across a range of contexts are provided with a broad foundation for further learning. Each unit is the result of a dynamic process where ideas and practices of both teachers and students are synthesised to arrive at a considered solution, the culmination of an engaging set of experiences.

A variety of strategies for designing, making and appraising work is available to teachers and students. The units in this document move beyond a sequenced plan and, to demonstrate a variety of contexts, approaches and applications, the selected topics and strategies are as diverse as the composition of the class groups. The critical consideration is to ensure that integrated programs are based on authentic connections and appropriate linkages.

INVESTIGATING AS A FOCUS

Students need to develop skills for investigating the world around them and to assess their findings. The results of students' investigations should inform the decisions they make as they progress through designing, making and appraising processes.

Investigating, using a range of methods

Students can use a range of methods for investigating, such as asking questions, listening to the opinions of others, gathering information using surveys and interviews, talking to people, and seeking advice from experts or visiting industry. There is also a range of telecommunications facilities, such as the phone, fax and computer, to enable them to access information.

Observation of environments and people, and experimenting with procedures and products are important investigative skills. Students need to access a variety of reference materials in a range of media, including printed, electronic and audio-visual.

Depending on the purpose of the investigation, students may need to develop skills in locating information, recording and analysing data gathered, writing or typing notes and faxes, recording interviews, photographing and making videos.

Students' analysis of their findings will involve counting and tallying statistical data, organising and presenting findings, using graphs, tables and data. Such activities can help to clarify understandings and stimulate ideas for design activities.

Students also need to develop skills in evaluating information by considering consistency, reliability and accuracy. Recognising the need to re-investigate, using the same or other sources, is also part of student-centred investigating.

Investigating for different purposes

Students should be able to identify and clarify the need to investigate as it arises, from personal, environmental, social, recreational or industrial concerns. Examples include:

- establishing the wants and needs of younger students;
- learning specific production techniques, such as taping a radio show segment, using music and advertisements with sound effects;
- examining the potential consequences or effects of recycling water;
- discovering more about the different types of fabrics available and their comparative costs;

- considering the ethical implications of battery-chicken farming;
- comparing aesthetic and functional features of clothes worn in the 1890s and 1990s;
- conducting opinion polls or surveys to find out about people's opinions and beliefs;
- comparing how farming methods used in Australia impact on the environment, compared with similar methods used in some African countries;
- assessing plans for a set design, by inviting a stage director to give feedback about props, lighting and sound to be used.

Investigating at different stages in the designing, making and appraising process

The need to investigate may arise at different times during technological activities. For example:

- when initially deciding how to proceed with a task;
- when a new area of need arises;
- when making improvements;
- if encountering an obstacle or difficulty;
- if changing direction;
- when needing to use a particular technique, material or process.

The best time for investigating is whenever the need for information or expertise arises. In planning programs, teachers need to plan opportunities for students to develop investigative skills and apply them for different purposes at different times. In this way, students learn skills and techniques as they need them and will find them more meaningful and useful.

Considerations for investigators

As information becomes rapidly more available, students may find that they come across contradictory materials. It is important that students understand that the nature of information is not static and new developments constantly change what is considered to be true, best or fair. It is also important that students value the need to verify what they have found out by reference to a range of sources. (Refer, for example, to "Vegie patch".)

Students need to learn the skills for checking their sources and critically examining what they discover. Information does not simply have to be old

to be considered unreliable. Investigating media sources will deliver a wealth of examples which are often sexist, ageist, unhealthy, or supportive of one particular point of view.

Investigating and reflecting

Frequently, students will clarify their understanding of what they have found out through discussions with their peers. Listening to others helps students reflect on what it is they are trying to find out.

The use of working definitions, which students develop individually or in small groups, can be referred to throughout a unit of work. This allows them to reflect on their learning and modify and refine their understandings.

Keeping a learning log throughout a unit of work is another means of keeping track of how a student's thinking can change. These methods need to be modelled, with time given during activities for students to think, write and share their thoughts with others.

Managing investigations

Students need to be clear about what it is they want to know and why. Finding out may be a simple first step. However, some investigations can be far more complex. It may be helpful if students become familiar with ways to structure what they do.

Strategies, such as brainstorming possible sources, prioritising tasks, negotiating the allocation of tasks to group members, developing timelines for doing things and considering how to present information can assist students to tackle investigations in an efficient and co-operative manner.

LEARNING LOGS

There are many different ways to approach documentation for primary students; the important thing is to ensure the method chosen makes the document useful and valued by both teacher and student. All of the units in this book refer to various methods of documenting students' learning, whether it be a learning log, a design folio, a technology book or a folder. For convenience, the term learning log is used here as a generic term.

A learning log is a document which contains ideas, sketches, thoughts, research, pamphlets, models, reflections, comments and any other material which illustrates the development of a solution. It can provide the teacher with an insight into the type of learning that has occurred and can be particularly helpful when making decisions about whether or not a student has achieved an outcome or level. It is, of course, only one indicator. If thoughts and ideas are accurately recorded, the teacher can learn much about the student's goals, accomplishments and ability to appraise.

Modelling the process

Students need to be taught how to use a learning log. A most effective method is to model the process. Any simple design task or project can be used as a whole-class exercise to model the recording process. Ideally, the learning log should be introduced during the first few units of the year.

Try stapling large sheets of butcher's paper together to create a class big book learning log. As you lead the class through the design process, record all ideas, paste in sketches (no matter how rough), note evaluation comments, and so on.

When making decisions, model the process of referring to previous thoughts and ideas, so that the students see the advantage of having recorded notions and judgements in the log. As students provide feedback, this should be recorded, perhaps by using a graffiti page opposite the design.

Students should be encouraged to reflect on their learning during technology projects. Again, use the big learning log and examine the types of learning that has occurred for the whole class.

Defining the expectations

Such an activity provides you with an opportunity to model your expectations and to demonstrate the value of recording design processes. It is important that students realise that all contributions should be included and that the learning log is not a presentation document. It is common for students to become involved in beautiful presentation and to lose the fundamental concept of recording the development of ideas.

Of course, there are occasions when presentation is of primary importance and students should be given opportunities to develop skills in presenting final solutions (as in "Changing environments") and creating presentation items ("Race day").

The dating of all work which is included in the learning log may prove to be important when assessing level development. Students need to be reminded to date all entries.

Besides modelling the usefulness of a learning log, demonstrate its worth by using one on a regular basis. By doing so, you can continue to show the value of recording ideas as a reference point for notes and plans.

Deciding what to include

Motivation is often lost if students are required to repeat the same format over and over again. We must remember that we want to develop an exciting and innovative learning environment, not one where too much of the lesson is taken up with recording.

If the teacher has decided that, in a particular unit, the focus will be on the testing of materials (as in "Kites by kids"), then it is likely that only this aspect of the process will be recorded. The learning log would be used for stating the problem, describing the experiment, materials or equipment used, labelling diagrams and discussing results.

The decision about which aspects of the process to record may relate to the achievement of specific outcomes. In "Vegie patch", for example, the teacher wanted to assess students in the Systems strand and therefore asked them to record their plans, ideas and responses to the activities which related to the development and maintenance of the vegetable garden.

Reflecting

Reflection is an important aspect of technology learning and can be done on an individual, small group or whole-class basis. It assists students to develop an understanding of the relationships between designing, making and appraising. They reflect on what they have learnt, the processes they have employed, their use of resources, how they have related to others, the implication of their solution and the development of their ideas.

When first introducing personal reflection, it may be helpful to provide some prompts in the form of questions. However, the teacher needs to be aware that such a format may restrict the lateral thinker in expressing his or her creativity. Reflection does not always have to be written down: a tape recorder or video camera may be an appropriate medium.

Role-play situations, where students are interviewed about their solution, or present their ideas to a "client" and debate about the benefits of their products, are useful strategies.

Recording group activities

Using co-operative groups in technology activities provides an opportunity for recording tasks to be shared. Each student is responsible for the documentation of his or her particular task. This can then be presented in a display folder, or on the wall. To provide each group with a particular display area – desks, shelves, wallboard, hanging space, or cloak room – can lead to some creative presentations. Part of the brief may be the presentation of the project to the class in a creative way.

Selecting the format

If an exercise book is used for recording, it may be useful to promote the idea of a draft or scribble page (as in "Vegie patch"). Every left-hand page could be left for sketches, comments and doodles. This can help overcome some students' reluctance to do "rough" work in a book. It is important that students learn to value such jottings, which may not normally be acceptable in other presentations. When assessing a student's learning, it is helpful for the teacher to be able to see this development of ideas.

The format used for documentation can be varied and should suit the unit of work. It may be more appropriate for each student to store all articles, including paper models, in a pouch or folder. A large scrap book enables worksheets to be pasted in, leaving space for students' comments. Display folders are useful, and students could store the different elements of a development – the rough sketches, more detailed drawings, working drawings with comments, reflective diary writings – in separate sleeves.

It is sometimes difficult to anticipate just how much documentation will be generated, and it will vary, in any case, from student to student.

A worthwhile document

Methods of recording learning should be varied and should be negotiated with the students: they can often be more innovative than the teacher! The most important thing to remember is that it should be a useful working document, valued by both student and teacher.

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